Date : May 14, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20E13-PTH04
Customer identification : Cardamom CO2 - France - CG8100203R
Type : CO2 extract
Source : *Elettaria cardamomum*
Customer : Plant Therapy

Analysis

Method: Dilution of a known amount with an appropriate solvent, and addition of a methyl octanoate internal standard for quantitation. Application of a correction factor[1]. Analysis with PC-PA-014 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Sylvain Mercier, M. Sc., Chimiste
Analysis date : May 13, 2020

Checked and approved by :

Alexis St-Gelais, M. Sc., chimiste 2013-174

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.

Reference

(1) Cachet, T.; Brevard, H.; Chaintreau, A.; Demyttenaere, J.; French, L.; Gassenmeier, K.; Joulain, D.; Koenig, T.; Leijs, H.; Liddle, P.; et al. IOFI Recommended Practice for the Use of Predicted Relative-Response Factors for the Rapid Quantification of Volatile Flavouring *Compounds by GC-FID. Flavour Fragr. J. 2016, 31 (3), 191–194.*

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PHYSICOCHEMICAL DATA

Physical aspect: Orange liquid
Refractive index: 1.4687 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

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ANALYSIS SUMMARY

Identification	(mg/g)	% of total volatiles	Classe
α-Thujene	0.82	0.10	Monoterpene
α-Pinene	5.36	0.67	Monoterpene
Camphene	0.11	0.01	Monoterpene
α-Fenchene	0.03	tr	Monoterpene
β-Pinene	1.71	0.21	Monoterpene
Sabinene	20.08	2.50	Monoterpene
Methyl 2-hydroxy-3-methylvalerate	0.16	0.02	Aliphatic ester
Myrcene	11.34	1.41	Monoterpene
Octanal	0.84	0.11	Aliphatic aldehyde
α-Terpinene	0.14	0.02	Monoterpene
para-Cymene	0.39	0.05	Monoterpene
Limonene	11.41	1.42	Monoterpene
1,8-Cineole	160.93	20.05	Monoterpenic ether
(*Z*)-β-Ocimene	0.13	0.02	Monoterpene
(*E*)-β-Ocimene	0.29	0.04	Monoterpene
γ-Terpinene	0.88	0.11	Monoterpene
cis-Sabinene hydrate	3.75	0.47	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.18	0.02	Monoterpenic alcohol
Octanol	0.38	0.05	Aliphatic alcohol
Terpinolene	0.39	0.05	Monoterpene
6,7-Epoxymyrcene	0.25	0.03	Monoterpenic ether
trans-Sabinene hydrate	2.41	0.30	Monoterpenic alcohol
Linalool	28.30	3.53	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.89	0.11	Monoterpenic alcohol
Borneol	0.15	0.02	Monoterpenic alcohol
δ-Terpineol	0.67	0.08	Monoterpenic alcohol
Terpinen-4-ol	4.34	0.54	Monoterpenic alcohol
para-Cymen-8-ol	0.05	0.01	Monoterpenic alcohol
α-Terpineol	17.10	2.13	Monoterpenic alcohol
Decanal	0.30	0.04	Aliphatic aldehyde
Octyl acetate	0.36	0.05	Aliphatic ester
trans-Carveol	0.11	0.01	Monoterpenic alcohol
cis-Sabinene hydrate acetate?	10.27	1.28	Monoterpenic ester
Neral	2.52	0.31	Monoterpenic aldehyde
Geraniol	7.17	0.89	Monoterpenic alcohol
Linalyl acetate	48.41	6.03	Monoterpenic ester
(2*E*)-Decenal	0.18	0.02	Aliphatic aldehyde
Geranial	4.31	0.54	Monoterpenic aldehyde
Bornyl acetate	0.35	0.04	Monoterpenic ester
Geranyl formate	0.39	0.05	Monoterpenic ester
Unknown	0.47	0.06	Unknown
δ-Terpinyl acetate	1.22	0.15	Monoterpenic ester
α-Terpinyl acetate	369.53	46.04	Monoterpenic ester
Neryl acetate	0.55	0.07	Monoterpenic ester
Geranyl acetate	4.06	0.51	Monoterpenic ester
Dodecenyl acetate isomer?	0.43	0.05	Aliphatic ester
Dodecenal isomer	0.48	0.06	Aliphatic aldehyde

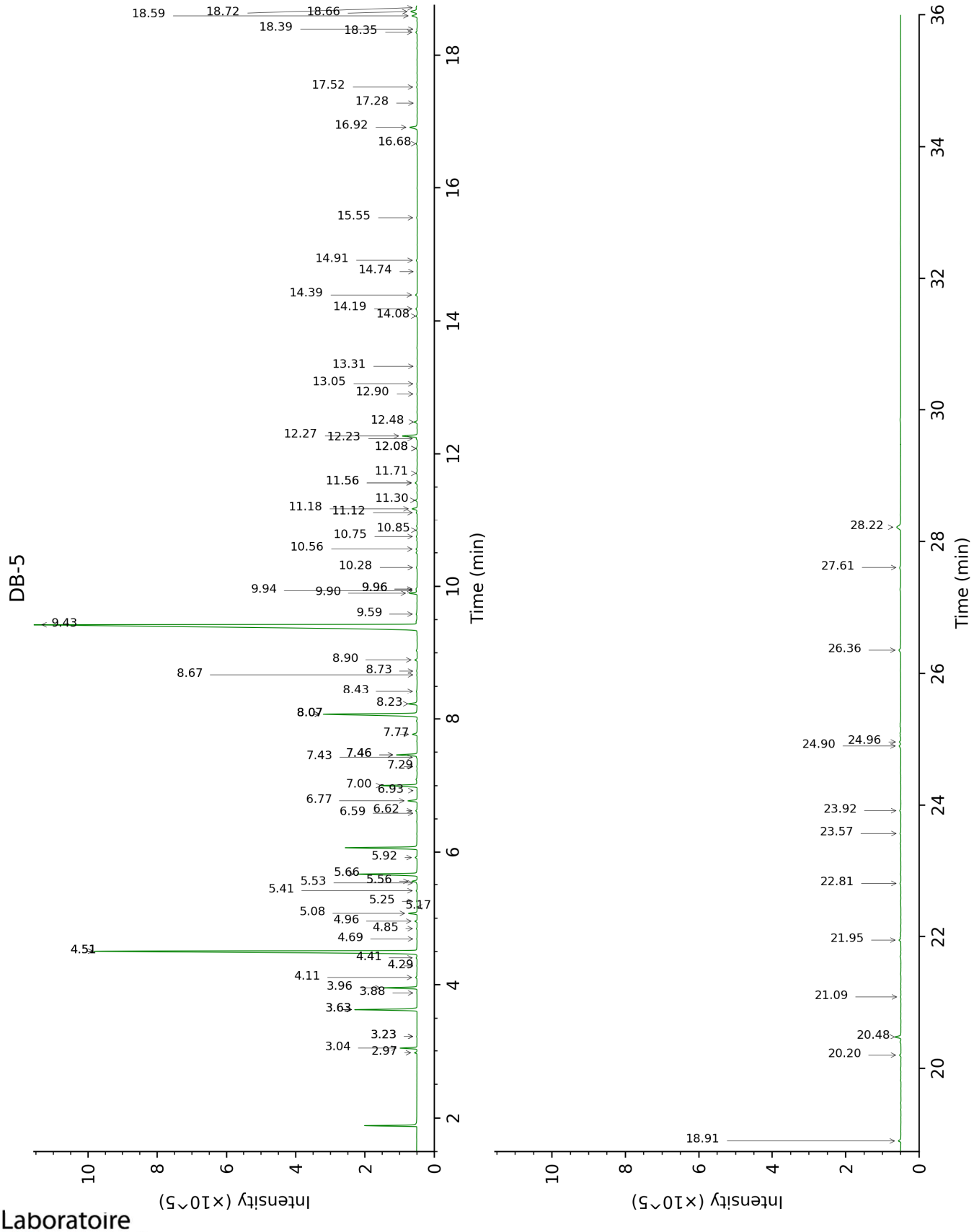
β-Elemene	0.18	0.02	Sesquiterpene
β-Caryophyllene	0.50	0.06	Sesquiterpene
α-Terpinyl propionate	0.68	0.09	Monoterpenic ester
Unknown	0.74	0.09	Sesquiterpene
8-Acetoxy-*trans*-para-Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]	0.46	0.06	Monoterpenic ester
Germacrene D	0.51	0.06	Sesquiterpene
β-Selinene	2.42	0.30	Sesquiterpene
α-Selinene	0.84	0.10	Sesquiterpene
γ-Cadinene	0.96	0.12	Sesquiterpene
Cubebol	0.41	0.05	Sesquiterpenic alcohol
δ-Cadinene	0.51	0.06	Sesquiterpene
Germacrene B	0.40	0.05	Sesquiterpene
8-Sobreryl acetate isomer	0.36	0.04	Monoterpenic ester
8-Acetoxycarvotanacetone	0.68	0.09	Monoterpenic ester
(*E*)-Nerolidol	7.07	0.88	Sesquiterpenic alcohol
(3*E*,7*E*)-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	1.40	0.18	Terpene derivative
Unknown	0.33	0.04	Oxygenated sesquiterpene
Unknown	0.42	0.05	Unknown
Unknown	0.19	0.02	Oxygenated sesquiterpene
(2*E*,6*Z*)-Farnesal	0.61	0.08	Sesquiterpenic aldehyde
(2*E*,6*E*)-Farnesol	0.87	0.11	Sesquiterpenic alcohol
(2*E*,6*E*)-Farnesal	0.95	0.12	Sesquiterpenic aldehyde
Myristic acid	0.17	0.02	Aliphatic acid
γ-Bicyclohomofarnesal	0.55	0.07	Terpenic aldehyde
(2*E*,6*E*)-Farnesyl acetate	0.49	0.06	Sesquiterpenic ester
(*E*)-15,16-Dinorlabda-8(17),12-dien-14-al?	0.70	0.09	Norditerpenic aldehyde
Palmitic acid	4.83	0.60	Aliphatic acid
Eicosane	0.10	0.01	Alkane
(*E*,*E*)-Geranyllinalool	0.36	0.04	Diterpenic alcohol
Heneicosane	0.70	0.09	Alkane
Coronarin *E*	0.25	0.03	Diterpene
Linoleic acid	3.15	0.39	Aliphatic acid
Oleic acid	4.41	0.55	Aliphatic acid
cis-Vaccenic acid?	0.96	0.12	Aliphatic acid
Stearic acid	1.51	0.19	Aliphatic acid
Tricosane	0.64	0.08	Alkane
(*E*)-Labda-8(17),12-diene-15,16-dial	3.45	0.43	Diterpenic aldehyde
Tetracosane	0.18	0.02	Alkane
Pentacosane	0.89	0.11	Alkane
Hexacosane	0.60	0.07	Alkane
Heptacosane	0.45	0.06	Alkane
Geranyl palmitate	0.68	0.08	Monoterpenic ester
Unknown	1.48	0.18	Unknown
Unknown	0.97	0.12	Unknown
Unknown	1.59	0.20	Unknown
Stigmasterol	0.85	0.11	Sterol
γ-Sitosterol?	3.49	0.43	Sterol
Consolidated total	**779.54 mg/g**	**97.12%**	

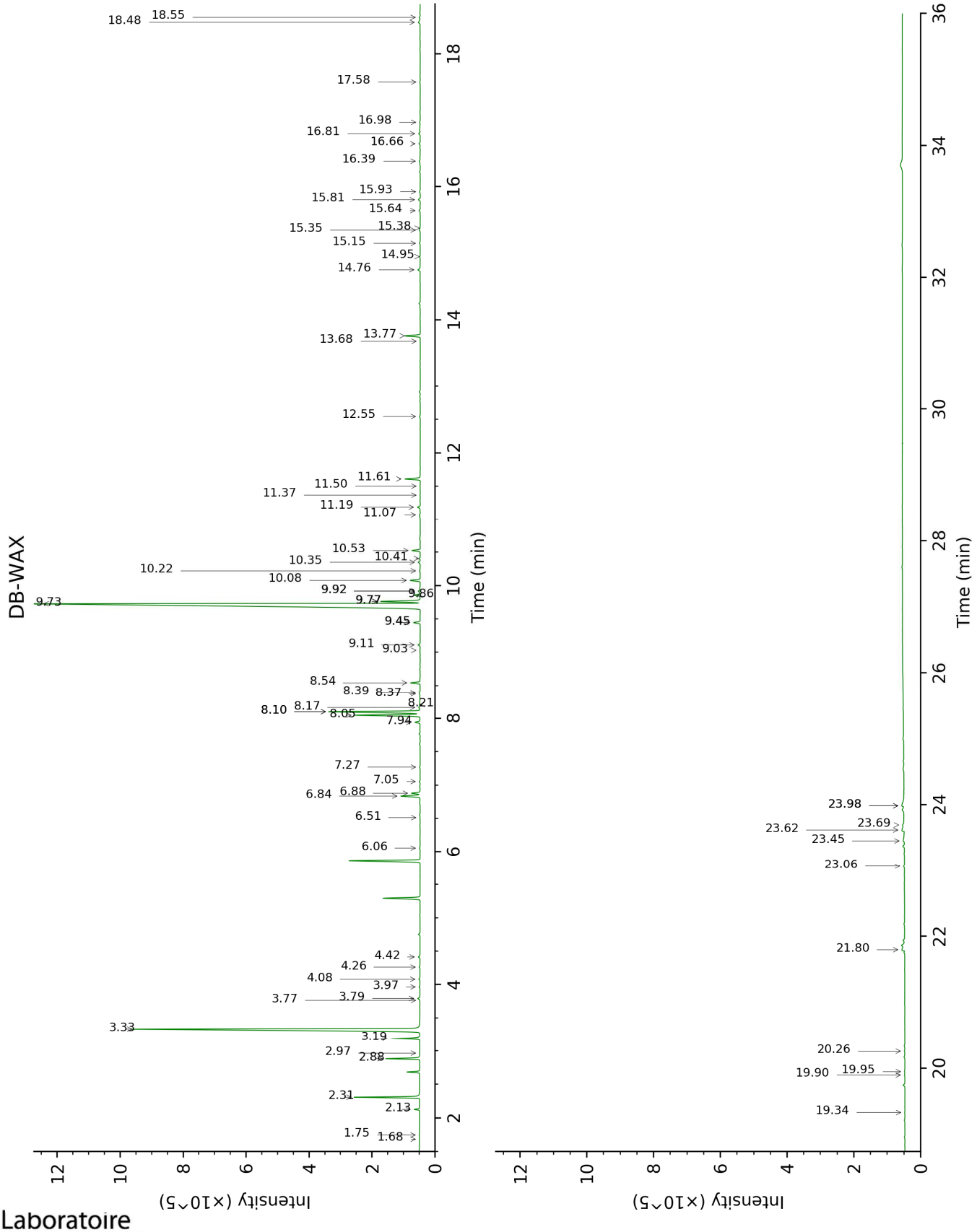
tr: The compound has been detected below 0.005% of total signal.

Individual compounds contents were corrected following the method of Cachet et al., 2016 (Flavour and Fragrance Journal guidelines).
Unknown compounds are expressed in equivalents of internal standard without correction.

About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

Unknowns: Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.


DB-5
Time (min)
Intensity (×10^5)
18.59
18.72
18.66
18.39
18.35
17.52
17.28
16.92
16.68
15.55
14.91
14.74
14.39
14.19
14.08
13.31
13.05
12.90
12.48
12.27
12.23
12.08
11.71
11.56
11.30
11.18
11.12
10.85
10.75
10.56
10.28
9.94
9.90
9.96
9.59
9.43
8.90
8.73
8.67
8.43
8.23
8.07
7.77
7.46
7.43
7.29
7.00
6.93
6.77
6.62
6.59
5.92
5.66
5.56
5.53
5.41
5.25
5.17
5.08
4.96
4.85
4.69
4.51
4.41
4.29
4.11
3.96
3.88
3.63
3.23
3.04
2.97
28.22
27.61
26.36
24.96
24.90
23.92
23.57
22.81
21.95
21.09
20.48
20.20
18.91


DB-WAX
Time (min)
Intensity (×10^5)
18.48
18.55
17.58
16.98
16.81
16.66
16.39
15.93
15.81
15.64
15.38
15.35
15.15
14.95
14.76
13.77
13.68
12.55
11.61
11.50
11.37
11.19
11.07
10.53
10.41
10.35
10.22
10.08
9.92
9.86
9.77
9.73
9.45
9.11
9.03
8.54
8.39
8.37
8.21
8.17
8.10
8.05
7.94
7.27
7.05
6.88
6.84
6.51
6.06
4.42
4.26
4.08
3.97
3.79
3.77
3.33
3.19
2.97
2.88
2.31
2.13
1.75
1.68
23.98
23.69
23.62
23.45
23.06
21.80
20.26
19.95
19.90
19.34

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	mg/g	R.T	R.I	mg/g
α-Thujene	2.97	928	0.82	1.49	1006	0.75
α-Pinene	3.04	932	5.36	1.43	1001	5.14
Camphene	3.23*	944	0.15	1.75	1032	0.11
α-Fenchene	3.23*	944	[0.15]	1.68	1026	0.03
β-Pinene	3.63*	971	22.25	2.13	1070	1.71
Sabinene	3.63*	971	[22.25]	2.31	1088	20.08
Methyl 2-hydroxy-3-methylvalerate	3.88	987	0.16			
Myrcene	3.96	992	11.34	2.88	1135	11.14
Octanal	4.11	1003	0.84	4.42	1251	0.80
α-Terpinene	4.29	1014	0.14	2.97	1141	0.10
para-Cymene	4.41	1021	0.39	4.08	1227	0.41
Limonene	4.51*	1028	156.41	3.19	1159	11.41
1,8-Cineole	4.51*	1028	[177.72]	3.33	1170	160.93
(*Z*)-β-Ocimene	4.69	1039	0.13	3.76	1204	0.12
(*E*)-β-Ocimene	4.85	1049	0.29	3.97	1218	0.34
γ-Terpinene	4.96	1056	0.88	3.79	1206	0.87
cis-Sabinene hydrate	5.08	1063	3.75	6.88	1427	3.94
cis-Linalool oxide (fur.)	5.17	1070	0.18	6.51	1400	0.20
Octanol	5.25	1075	0.38	8.17	1524	0.56
Terpinolene	5.41	1085	0.39	4.26	1240	0.35
6,7-Epoxymyrcene	5.53	1092	0.25	6.06	1367	0.39
trans-Sabinene hydrate	5.56	1094	2.41	7.94	1507	2.39
Linalool	5.66	1101	28.30	8.05	1515	28.13
cis-para-Menth-2-en-1-ol	5.92	1117	0.89	8.10*	1519	44.82
Borneol	6.59	1161	0.15	9.76*	1650	17.95
δ-Terpineol	6.62	1163	0.67	9.45*	1624	3.16
Terpinen-4-ol	6.77	1173	4.34	8.54	1553	4.32
para-Cymen-8-ol	6.93	1183	0.05	11.50	1795	0.14
α-Terpineol	7.00	1188	17.10	9.76*	1650	[17.95]
Decanal	7.29	1206	0.30	7.27	1456	0.33
Octyl acetate	7.43	1216	0.36	7.06	1440	0.38
trans-Carveol	7.46*	1219	9.83	11.37	1783	0.11
cis-Sabinene hydrate acetate?	7.46*	1219	[10.61]	6.84	1424	10.27
Neral	7.77	1240	2.52	9.45*	1624	[3.22]
Geraniol	8.07*	1261	52.15	11.61	1804	7.17
Linalyl acetate	8.07*	1261	[57.46]	8.10*	1519	[49.39]
(2*E*)-Decenal	8.07*	1261	[52.15]	9.03	1591	0.18
Geranial	8.23	1271	4.31	10.08	1676	4.77
Bornyl acetate	8.43	1285	0.35	8.21	1527	0.18
Geranyl formate	8.67	1302	0.39	9.92*	1663	1.28
Unknown [m/z 69, 41 (75), 55 (58), 83 (33), 121 (33)...]	8.73	1306	0.47			
δ-Terpinyl acetate	8.90	1313	1.22	9.11	1597	1.26
α-Terpinyl acetate	9.43	1350	369.53	9.73	1647	363.21
Neryl acetate	9.59	1362	0.55	10.22	1687	0.45

Geranyl acetate	9.90	1384	4.06	10.53	1712	4.21
Dodecenyl acetate isomer?	9.94	1386	0.43			
Dodecenal isomer	9.96*	1388	0.68			
β-Elemene	9.96*	1388	[0.61]	8.37	1540	0.18
β-Caryophyllene	10.28	1411	0.50	8.39	1542	0.47
α-Terpinyl propionate	10.56	1432	0.68			
Unknown [m/z 43, 109 (35), 96 (23), 93 (22), 137 (21), 81 (20)...204 (5)]	10.75	1446	0.74			
8-Acetoxy-*trans*-para-Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]	10.84	1453	0.46	15.15	2134	0.59
Germacrene D	11.12	1473	0.51	9.76*	1650	[15.51]
β-Selinene	11.18	1478	2.42	9.86	1658	2.75
α-Selinene	11.30	1487	0.84	9.92*	1663	[0.98]
γ-Cadinene	11.56*	1507	1.09	10.35	1698	0.96
Cubebol	11.56*	1507	[1.19]	12.55	1887	0.41
δ-Cadinene	11.71	1518	0.51	10.41	1702	0.50
Germacrene B	12.08*	1547	0.53	11.07	1758	0.40
8-Sobreryl acetate isomer	12.08*	1547	[0.76]	16.98	2321	0.36
8-Acetoxycarvotanacetone	12.23	1559	0.68	15.64	2182	0.92
(*E*)-Nerolidol	12.27	1562	7.07	13.77	1999	6.87
(3*E*,7*E*)-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	12.48	1579	1.40	11.19	1768	1.28
Unknown [m/z 81, 43 (52), 161 (49), 105 (30), 207 (27), 95 (26), 93 (24), 109 (24)...]	12.90	1612	0.33	14.95	2114	0.29
Unknown [m/z 43, 71 (53), 108 (47), 126 (41), 109 (35), 93 (25)...]	13.05	1625	0.42	19.95	2657	0.35
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	13.31	1646	0.19	15.38	2156	0.19
(2*E*,6*Z*)-Farnesal	14.08	1710	0.61	15.35	2154	0.59
(2*E*,6*E*)-Farnesol	14.19	1719	0.87	16.81	2303	0.72
(2*E*,6*E*)-Farnesal	14.40	1738	0.95	15.81	2199	0.96
Myristic acid	14.74	1768	0.17			
γ-Bicyclohomofarnesal	14.92	1783	0.55			
(2*E*,6*E*)-Farnesyl acetate	15.55	1840	0.49	15.92	2212	0.39
(*E*)-15,16-Dinorlabda-8(17),12-dien-14-al?	16.68	1944	0.70	16.39	2260	0.71
Palmitic acid	16.92	1967	4.83	21.80	2886	2.77
Eicosane	17.28	2002	0.10	13.68	1992	0.04
(*E*,*E*)-Geranyllinalool	17.52	2026	0.36	18.55	2494	0.43

Heneicosane	18.35	2108	0.70	14.76	2094	1.18
Coronarin *E*	18.39	2112	0.25	19.90	2651	0.21
Linoleic acid	18.59	2133	3.15	23.98*	3180	3.32
Oleic acid	18.66	2140	4.41	23.62	3129	2.84
cis-Vaccenic acid?	18.72	2146	0.96	23.69	3140	1.60
Stearic acid	18.91	2166	1.51	23.45	3106	1.50
Tricosane	20.20	2304	0.64	16.66	2287	0.59
(*E*)-Labda-8(17),12-diene-15,16-dial	20.48	2336	3.45	23.98*	3180	[3.35]
Tetracosane	21.09	2404	0.18	17.58	2386	0.13
Pentacosane	21.95	2505	0.89	18.48	2486	0.86
Hexacosane	22.81	2609	0.60	19.34	2584	0.13
Heptacosane	23.57	2706	0.45	20.26	2694	0.23
Geranyl palmitate	23.92	2750	0.68	23.06	3054	0.48
Unknown [m/z 97, 57 (94), 83 (92), 55 (70), 69 (70), 43 (60)...]	24.90	2880	1.48			
Unknown [m/z 97, 57 (92), 83 (88), 69 (73), 55 (69), 43 (62)...]	24.96	2888	0.97			
Unknown [m/z 97, 57 (94), 83 (90), 55 (76), 69 (71), 43 (66)...]	26.36	3080	1.59			
Stigmasterol	27.61	3221	0.85			
γ-Sitosterol?	28.22	3275	3.49			

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
tr: The compound has been detected below 0.005% of total signal.

Individual compounds contents were corrected following the method of Cachet et al., 2016 (Flavour and Fragrance Journal guidelines).
Unknown compounds are expressed in equivalents of internal standard without correction.
R.T.: Retention time (minutes)
R.I.: Retention index